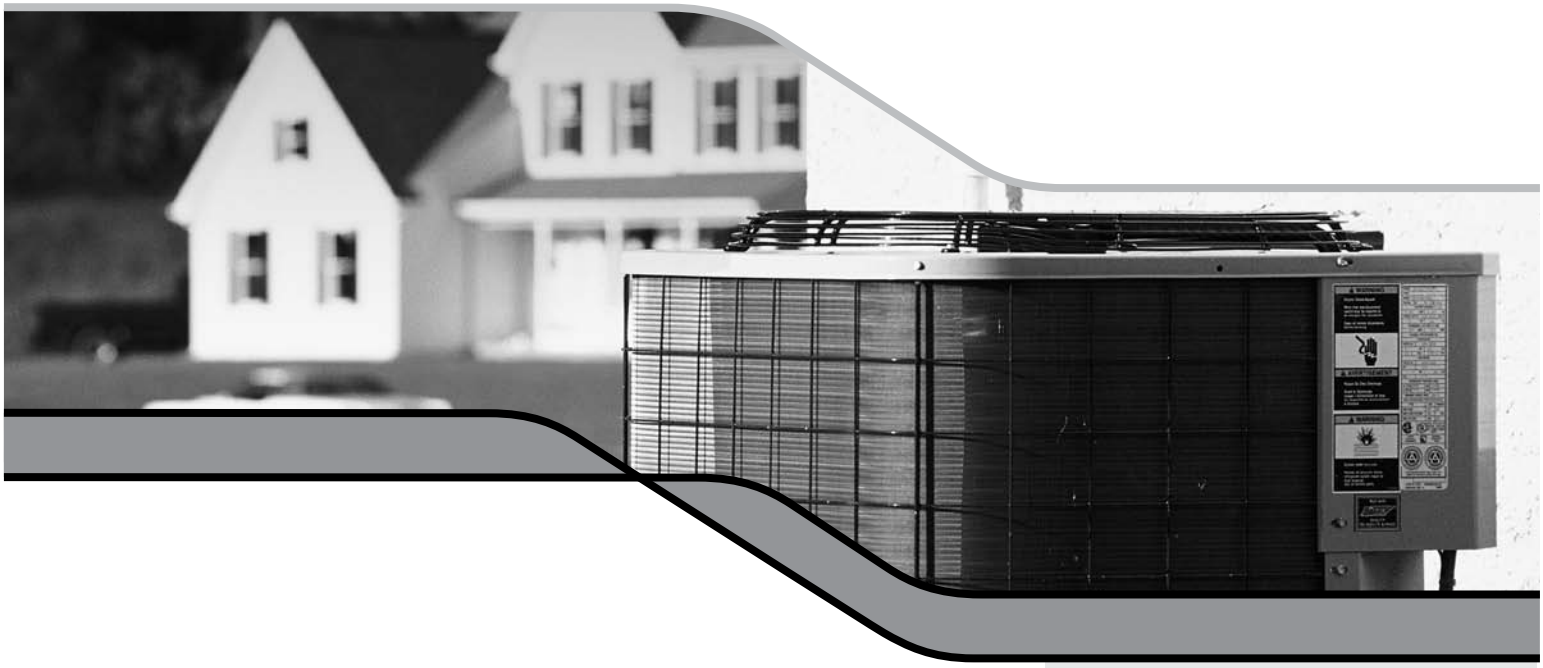
IDAHO POWER®
An IDACORP Company

Heating and Cooling Efficiency Program

Program Requirements Manual



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1. Program Logistics

The purpose of the Idaho Power Heating and Cooling Efficiency Program ("Program") is to encourage residential customers to purchase, install and operate energy efficient heating and cooling equipment. The Program promotes sizing and installation techniques that are designed to maximize system performance. By helping customers reduce their energy use, Idaho Power helps customers save money on their energy bills and helps reduce the growing demand for power in this region.

A. Benefits of Participation

- Cash Incentives- For the sizing and installation of qualified energy efficient equipment using "best practices" methods.
- Market Differentiation- Offer energy efficiency and quality installation as part of your customer service value.
- Promotion- Idaho Power lists Participating Companies on the Idaho Power Web site.
- Enhanced Comfort and On-going Savings – Equipment that performs as designed, because it is sized and installed to best practices, improves customer comfort and saves energy.

B. Eligible Customers

Residential customers who reside in Idaho Power service territory, new construction home builders and property owners/managers who build/own homes within the Idaho Power service territory; and,
- have purchased a qualified heat pump and had it installed to meet the Program requirements, and
- have HVAC equipment installed by a Participating Company.

C. Steps to Become a Participating Company

The following steps are required for an HVAC company to become a "Participating Company" with the Program:

1) Attend training. Installers must attend the Idaho Power sponsored Program training.

2) Complete and submit the HVAC Contractor Participation Agreement and W-9. The Program will require annual renewal of these documents.

3) Purchase the TrueFlow® Meter and manometer for Program use.

4) Agree to random On-Site Verification inspections.

5) When steps 1-4 have been completed, prior to listing on the Idaho Power Program Web site, the Company will need to submit a qualifying incentive application that passes On-Site Verification. More information can be found in the On-Site Verification section on page 3.

Once on the Idaho Power Web site list of participating companies, companies must adhere to Program guidelines and fulfill the expectations of being a Participating Company.

D. On-Site Verification

Idaho Power conducts on-site verifications, or OSVs, to ensure that qualifying product installations meet Program requirements.

All Contractors new to the Program are required to have the first installation job site verified and OSVd by the Program. The HVAC Company will be listed on the Program Web site after a successful first job is completed.

Idaho Power will also perform randomly selected in-field on-site verifications.

If Contractors have performed work that is not in compliance with the Program requirements, they will be notified. Idaho Power's expectation is that the Contractor will make the necessary corrections for the installation to meet Program standards. Contractors whose work consistently does not meet Program requirements will be removed from the Program.

Idaho Power reserves the right to notify the customer of on-site verification findings.

E. Incentive Applications

Incentive applications can be downloaded at www.IdahoPower.com/heatingcooling. Participating companies submit the incentive application forms and supporting documents to the Program on behalf of the customer.

Note: Filling out forms correctly and completely will result in incentives being processed more quickly.

2. Requirements for Air Source Heat Pumps

Approved Scenarios for Receiving an Air-Source Heat Pump Incentive

1. Air Source Heat Pump to Air-Source Heat Pump

Customers are eligible for an incentive when they replace an existing air source heat pump with a high efficiency air-source heat pump. Equipment must meet the minimum efficiency requirements and sized and installed to Program standards by a trained installer working for a participating company. For specification details, reference the Air-Source Heat Pump to Air Source Heat Pump Criteria section on page 6.

Customer Incentive
$200; Minimum efficiency 8.2 HSPF
$250; Minimum efficiency 8.5 HSPF
Limited to two air source heat pump installations per household.

2. Electric Heating System to Air-Source Heat Pump

Customers are eligible for an incentive when they replace an existing electric heating system (i.e. electric furnace, baseboards, electric forced air furnace, etc.) with an air source heat pump with electric backup only. Equipment must meet the minimum efficiency requirements and sized and installed to Program standards by a trained installer working for a participating company. For specification details, reference the Electric System to Air-Source Heat Pump Criteria section on page 7.

Customer Incentive
$300; Minimum efficiency 8.2 HSPF
$400; Minimum efficiency 8.5 HSPF
Limited to two air source heat pump installations per household.

3. Oil or Propane Heating System to Air-Source Heat Pump

If a home has a heating system that uses oil or propane and the **home is located in an area where natural gas is not available**, the Program will incent on a qualified air source heat pump installation. Equipment must meet the minimum efficiency requirements and sized and installed to Program standards by a trained installer working for a participating company. For specification details, reference the Oil or Propane Heating System to Air-Source Heat Pump Criteria section on page 8.

Customer Incentive
$300; Minimum efficiency 8.2 HSPF
$400; Minimum efficiency 8.5 HSPF
Limited to two air source heat pump installations per household.

4. New Construction Air-Source Heat Pump

If the **home is being constructed in an area where natural gas is not available**, the Program will incent on a qualified air source heat pump installation. Equipment must meet the minimum efficiency requirements and sized and installed to Program standards by a trained installer working for a participating company. For specification details, reference the New Construction Air-Source Heat Pump Criteria section on page 9.

Customer Incentive
$300; Minimum efficiency 8.2 HSPF
$400; Minimum efficiency 8.5 HSPF
Limited to two air-source heat pump installations per household.

3. Requirements for Open Loop Water Source Heat Pumps

Approved Scenarios for Receiving an Open Loop Water Source Heat Pump Incentive

Note: There are no incentives for an open loop water source heat pump to open loop water source heat pump system replacement.

1. Air-Source Heat Pump to Open Loop Water Source Heat Pump

Customers are eligible for an incentive when they replace an existing air source heat pump with an open loop water source heat pump. Equipment must meet minimum efficiency requirements and sized and installed to meet Program standards by a trained installer working for a participating company. For specification details, reference the Air-Source Heat Pump to Open Loop Water Source Heat Pump Criteria section on page 10.

Customer Incentive
$500; Minimum efficiency 3.5 COP
Limited to one unit installed per household.

2. Electric Heating System to Open Loop Water Source Heat Pump

Customers are eligible for an incentive when they replace an existing electric heating system (i.e. electric furnace, baseboards, etc.) with an open loop water source heat pump with electric backup only. Equipment must meet the minimum efficiency requirements and sized and installed to meet Program standards by a trained installer working for a participating company. For specification details, reference the Electric Heating System to Open Loop Water Source Heat Pump Criteria section on page 11.

Customer Incentive
$1,000; Minimum efficiency 3.5 COP
Limited to one unit installed per household.

3. Oil or Propane Heating System to Open Loop Water Source Heat Pump

If a home has a heating system that uses oil or propane **and the home is located in an area where natural gas is not available**, the Program will incent on a qualified open loop water source heat pump installation. Equipment must meet the minimum efficiency requirements and sized and installed to meet Program criteria by a trained installer working for a participating company. For specification details, reference the Oil or Propane Heating System to Open Loop Water Source Heat Pump Criteria section on page 11.

Customer Incentive
$1,000; Minimum efficiency 3.5 COP
Limited to one unit installed per household.

4. New Construction Open Loop Water Source Heat Pump

If the **home is being constructed in an area where natural gas is not available**, the Program will incent on a qualified open loop water source heat pump installation. Equipment must meet the minimum efficiency requirements and sized and installed to meet Program criteria by a trained installer working for a participating company. For specification details, reference the New Construction Open Loop Water Source Heat Pump Criteria section on page 12.

Customer Incentive
$1,000; Minimum efficiency 3.5 COP
Limited to one unit installed per household.

4. Air-Source Heat Pump Measure Criteria

A. Air Source Heat Pump to Air Source Heat Pump Criteria

Equipment Qualification

- ☐ Heat pump meets one of the following as determined by AHRI Standard 210/240:
  - 8.2 HSPF
  - 8.5 or higher HSPF
- ☐ AHRI-rated/matching condensing unit and evaporator coil installed (split systems only) and listed in the AHRI Certified Directory of Unitary Equipment found at www.ahridirectory.org.
- ☐ Heat pump is 5 tons or less.
- ☐ Heat pump is sized using Manual J and Manual S or equivalent and selected coil combination has capacity that is within ½ ton of the calculated dominant (larger) load. The cooling design load is calculated at the appropriate design temperature and includes solar gains. The heating load shall be calculated at 30°F outside temperature (30°F balance point method).
- ☐ Heat pump replaces an existing heat pump.

Installation Qualification

- ☐ Visually inspect ductwork; verify there are no disconnected ducts. Repair disconnect(s) before installing equipment.
- ☐ Confirm system airflow is at least 350 CFM/Ton as measured with TrueFlow® Meter. Refer to Appendix E for general guidance on duct sizing.
- ☐ Confirm refrigerant charge is within 3° of target subcooling when checked in either cooling or heating mode (latter only applies if outdoor unit has TXV). For winter installations (outdoor temperature below 65° F), Installer also has option of comparing suction and discharge pressures with manufacturer targets. (See Note at end of Section 4 or Appendix B for more details.)

Heat Pump Controls Setup/Checkout

- ☐ Auxiliary heat can never operate on Stage 1 heating call.
- ☐ Compressor low-ambient lockout is set no higher than 0°F.
- ☐ If outdoor sensor is used to control auxiliary heat, sensor output (omhs) is checked and compared to expected value.
- ☐ For typical set-up instructions, refer to VisionPRO® 8000 Thermostat Installer pocket guide at http://customer.honeywell.com/techlit/pdf/69-0000s/69-1871.pdf.

Single Stage Compressor Systems

- ☐ Confirm discharge air temperature sensor is not installed or is disabled.
- ☐ Confirm auxiliary heat cannot operate at outside air temperatures above 35°F.

Multi-Stage Compressor Systems (or systems with multiple air zones)

- ☐ If discharge air temperature sensor can control auxiliary heat, confirm staging temp. is set no higher than 85°F, OR
- ☐ If staging temperature is set above 85°F, confirm resistance heat cannot operate at outside temperature above 35°F.

Note: If the air-source heat pump is sized to Program standards, heating rate of recovery and comfort will be sufficient. Note that strip heat can be used to supplement the compressor when outdoor temperatures are be low 35°F.

Submit the following to Idaho Power

To avoid a delay in processing, ensure forms and worksheets are completed in full.

- ☐ Air Source Heat Pump Incentive Application
- ☐ Air Source Heat Pump Installation Worksheet
- ☐ Certificate of AHRI-Certified Performance for heat pump (or AHRI number)
- ☐ Manual J or equivalent (such as the Idaho Power Heat Pump Sizing Worksheet)
- ☐ Copy of proof of payment and a copy of itemized receipt/invoice

B. Electric Heat System to Air Source Heat Pump Criteria

Equipment Qualification

- ☐ Heat pump meets one of the following as determined by AHRI Standard 210/240:
  - 8.2 HSPF
  - 8.5 or higher HSPF
- ☐ AHRI-rated/matching condensing unit and evaporator coil installed (split systems only) and listed in the AHRI Certified Directory of Unitary Equipment found at www.ahridirectory.org.
- ☐ Heat pump is 5 tons or less.
- ☐ Heat pump is sized using Manual J and Manual S or equivalent and selected coil combination has capacity that is within ½ ton of the calculated dominant (larger) load. The cooling design load is calculated at the appropriate design temperature and includes solar gains. The heating load shall be calculated at 30°F out side temperature (30°F balance point method).
- ☐ Heat pump replaces an existing electric heating system (i.e. furnace, baseboards, etc.) with a heat pump with electric backup.

Installation Qualification

- ☐ Visually inspect ductwork; verify there are no disconnected ducts. Repair disconnect(s) before installing equipment.
- ☐ Confirm system airflow is at least 350 CFM/Ton as measured with TrueFlow® Meter. Refer to Appendix E for general guidance on duct sizing.
- ☐ Confirm refrigerant charge is within 3° of target subcooling when checked in either cooling or heating mode (latter only applies if outdoor unit has TXV). For winter installations (outdoor temperature below 65º F), Installer also has option of comparing suction and discharge pressures with manufacturer targets. (See Note at the end of this Section (4) or Appendix B for more details.)

Heat Pump Controls Setup/Checkout

- ☐ Auxiliary heat can never operate on Stage 1 heating call.
- ☐ Compressor low-ambient lockout is set no higher than 0°F.
- ☐ If outdoor sensor is used to control auxiliary head, sensor output (ohms) is checked and compared to expected value.
- ☐ For typical set-up instructions, refer to VisionPRO® 8000 Thermostat Installer pocket guide at http://customer.honeywell.com/techlit/pdf/69-0000s/69-1871.pdf.

Single Stage Compressor Systems

- ☐ Confirm discharge air temperature sensor is not installed or is disabled.
- ☐ Confirm auxiliary heat cannot operate at outside air temperatures above 35°F.

Multi-Stage Compressor Systems (or systems with multiple air zones)

- ☐ If discharge air temperature sensor can control auxiliary heat, confirm staging temp. is set no higher than 85°F, OR
- ☐ If staging temperature is set above 85°F, confirm resistance heat cannot operate at outside temperature above 35°F.

Note: If the air-source heat pump is sized to Program standards, heating rate of recovery and comfort will be sufficient. Note that strip heat can be used to supplement the compressor when outdoor temperatures are below 35°F.

Submit the following to Idaho Power

To avoid a delay in processing, ensure forms and worksheets are completed in full.

- ☐ Air Source Heat Pump Incentive Application
- ☐ Air Source Heat Pump Installation Worksheet
- ☐ Certificate of AHRI-Certified Performance for heat pump (or AHRI number)
- ☐ Manual J or equivalent (such as the Idaho Power Heat Pump Sizing Worksheet)
- ☐ Copy of proof of payment and a copy of itemized receipt/invoice

C. Oil or Propane Heating System to Air Source Heat Pump Criteria

Equipment Qualification

- ☐ Heat pump meets one of the following as determined by AHRI Standard 210/240:
  - 8.2 HSPF
  - 8.5 or higher HSPF
- ☐ AHRI-rated/matching condensing unit and evaporator coil installed (split systems only) and listed in the AHRI Certified Directory of Unitary Equipment found at www.ahridirectory.org.
- ☐ Heat pump is 5 tons or less.
- ☐ Heat pump is sized using Manual J and Manual S or equivalent and selected coil combination has capacity that is within ½ ton of the calculated dominant (larger) load. The cooling design load is calculated at the appropriate design temperature and includes solar gains. The heating load shall be calculated at 30°F outside temperature (30°F balance point method).

Installation Qualification

- ☐ Visually inspect ductwork; verify there are no disconnected ducts. Repair disconnect(s) before installing equipment.
- ☐ Confirm system airflow is at least 350 CFM/Ton as measured with TrueFlow® Meter. Refer to Appendix E for general guidance on duct sizing.
- ☐ Confirm refrigerant charge is within 3° of target subcooling when checked in either cooling or heating mode (latter only applies if outdoor unit has TXV). For winter installations (outdoor temperature below 65º F), Installer also has option of comparing suction and discharge pressures with manufacturer targets. (See Note at the end of this Section (4) or Appendix B for more details.)
- ☐ Home must be located in an area where natural gas is not available.

Heat Pump Controls Setup/Checkout

- ☐ Auxiliary heat can never operate on Stage 1 heating call.
- ☐ Compressor low-ambient lockout is set no higher than 0°F.
- ☐ If outdoor sensor is used to control auxiliary heat, sensor output (ohms) is checked and compared to expected value.
- ☐ For typical set-up instructions, refer to VisionPRO® 8000 Thermostat Installer pocket guide at http://customer.honeywell.com/techlit/pdf/69-0000s/69-1871.pdf.

Single Stage Compressor Systems

- ☐ Confirm discharge air temperature sensor is not installed or is disabled.
- ☐ Confirm auxiliary heat cannot operate at outside air temperatures above 35°F.

Multi-Stage Compressor Systems (or systems with multiple air zones)

- ☐ If discharge air temperature sensor can control auxiliary heat, confirm staging temp. is set no higher than 85°F, OR
- ☐ If staging temperature is above set above 85°F, confirm resistance heat cannot operate at outside temperature above 35°F.

Note: If the air-source heat pump is sized to Program standards, heating rate of recovery and comfort will be sufficient. Note that strip heat can be used to supplement the compressor when outdoor temperatures are below 35°F.

Submit the following to Idaho Power

To avoid a delay in processing, ensure forms and worksheets are completed in full.

- ☐ Air Source Heat Pump Incentive Application
- ☐ Air Source Heat Pump Installation Worksheet
- ☐ Certificate of AHRI-Certified Performance for heat pump (or AHRI number)
- ☐ Manual J or equivalent (such as the Idaho Power Heat Pump Sizing Worksheet)
- ☐ Copy of proof of payment and a copy of itemized receipt/invoice

D. New Construction Air Source Heat Pump Criteria

Equipment Qualification

- ☐ Heat pump meets one of the following as determined by AHRI Standard 210/240:
  - 8.2 HSPF
  - 8.5 or higher HSPF
- ☐ AHRI-rated/matching condensing unit and evaporator coil installed (split systems only) and listed in the AHRI Certified Directory of Unitary Equipment found at www.ahridirectory.org.
- ☐ Heat pump is 5 tons or less.
- ☐ Heat pump is sized using Manual J and Manual S or equivalent and selected coil combination has capacity that is within ½ ton of the calculated dominant (larger) load. The cooling design load is calculated at the appropriate design temperature and includes solar gains. The heating load shall be calculated at 30°F outside temperature (30°F balance point method).
- ☐ Home is constructed in an area where natural gas is not available.
- ☐ Construction must be completed and certificate of occupancy issued prior to submitting incentive paperwork.

Installation Qualification

- ☐ Visually inspect ductwork; verify there are no disconnected ducts. Repair disconnect(s) before installing equipment.
- ☐ Confirm system airflow is at least 350 CFM/Ton as measured with TrueFlow® Meter. Refer to Appendix E for general guidance on duct sizing.
- ☐ Confirm refrigerant charge is within 3° of target subcooling when checked in either cooling or heating mode (latter only applies if outdoor unit has TXV). For winter installations (outdoor temperature below 65° F), Installer also has option of comparing suction and discharge pressures with manufacturer targets. (See Note at the end of this Section (4) or Appendix B for more details.)

Heat Pump Controls Setup/Checkout

- ☐ Auxiliary heat can never operate on Stage 1 heating call.
- ☐ Compressor low-ambient lockout is set no higher than 0°F.
- ☐ If outdoor sensor is used to control auxiliary heat, sensor output (ohms) is checked and compared to expected value.
- ☐ For typical set-up instructions, refer to VisionPRO® 8000 Thermostat Installer pocket guide at http://customer.honeywell.com/techlit/pdf/69-0000s/69-1871.pdf.

Single Stage Compressor Systems

- ☐ Confirm discharge air temperature sensor is not installed or disabled.
- ☐ Confirm auxiliary heat cannot operate at outside air temperatures above 35°F.

Multi-Stage Compressor Systems (or systems with multiple air zones)

- ☐ If discharge air temperature sensor can control auxiliary heat, confirm staging temp. is set no higher than 85°F, OR
- ☐ If staging temperature is set above 85°F, confirm resistance heat cannot operate at outside temperature above 35°F.

Note: If the air-source heat pump is sized to Program standards, heating rate of recovery and comfort will be sufficient. Note that strip heat can be used to supplement the compressor when outdoor temperatures are below 35°F.

Submit the following to Idaho Power

To avoid a delay in processing, ensure forms and worksheets are completed in full.

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- ☐ Air Source Heat Pump Installation Worksheet
- ☐ Certificate of AHRI-Certified Performance for heat pump (or AHRI number)
- ☐ Manual J or equivalent (such as the Idaho Power Heat Pump Sizing Worksheet)
- ☐ Copy of proof of payment and a copy of itemized receipt/invoice

Note: Winter Installation Criteria If an air-source heat pump is installed in the winter (outdoor temperature below 65°F), the installer can confirm accuracy of charge by comparing operating suction and discharge pressures with manufacturer's target values (which are typically listed vs. outdoor temperature). Line set adjustments must be made before checking charge. Manufacturers typically allow a 5 or 10 psig tolerance band around the target operating pressures.

5. Open Loop Water Source Heat Pump Measure Criteria

A. Air Source Heat Pump to Open Loop Water Source Heat Pump Criteria

Equipment Qualification

- ☐ Heat pump is
  - Minimum 3.5 COP as listed on the AHRI certificate
- ☐ Heat pump is 6 tons or less.
- ☐ Heat pump is sized using Manual J and Manual S or equivalent and selected coil combination has capacity that is within ½ ton of the calculated dominant (larger) load. The cooling design load is calculated at the appropriate design temperature and includes solar gains. The heating load shall be calculated at 30°F outside temperature (30°F balance point method).
- ☐ Heat pump replaces an existing air source heat pump.
- ☐ Limited to one unit per household.

Installation Qualification

- ☐ Visually inspect ductwork; verify there are no disconnected ducts. Repair disconnect(s) before installing equipment.
- ☐ Confirm system airflow is at least 350 CFM/Ton as measured with TrueFlow® Meter. Refer to Appendix E for general guidance on duct sizing.
- ☐ Compare measured loop and air-side temperature splits to manufacturer's targets. If measured values are not within manufacturer tolerances, make adjustments and retest.
- ☐ Confirm auxiliary (strip) heat cannot operate at outdoor temperatures above 35°F (or the lowest temperature setting allowed by the thermostat).

Submit the following to Idaho Power

To avoid a delay in processing, ensure forms and worksheets are completed in full.

- ☐ Open Loop Water Source Heat Pump Incentive Application
- ☐ Open Loop Water Source Heat Pump Installation Worksheet
- ☐ Certificate of AHRI-Certified Performance
- ☐ Manual J or equivalent (such as the Idaho Power Heat Pump Sizing Worksheet). Use care in selecting the proper Entering Water Temperature when selecting equipment.
- ☐ Copy of itemized receipt/invoice

B. Electric Heat System to Open Loop Water Source Heat Pump Criteria

Equipment Qualification

- ☐ Heat pump is
  - Minimum 3.5 COP as listed on the AHRI certificate
- ☐ Heat pump is 6 tons or less.
- ☐ Heat pump is sized using Manual J and Manual S or equivalent and selected coil combination has capacity that is within ½ ton of the calculated dominant (larger) load. The cooling design load is calculated at the appropriate design temperature and includes solar gains. The heating load shall be calculated at 30 F outside temperature (30°F balance point method).
- ☐ Heat pump replaces an existing electric heating system (i.e. furnace, baseboards, etc.) with a heat pump with electric backup.
- ☐ Limited to one unit per household.

Installation Qualification

- ☐ Visually inspect ductwork; verify there are no disconnected ducts Repair disconnect(s) before installing equipment.
- ☐ Confirm system airflow is at least 350 CFM/Ton as measured with TrueFlow® Meter. Refer to Appendix E for general guidance on duct sizing.
- ☐ Compare measured loop and air-side temperature splits to manufacturer's targets. If measured values are not within manufacturer tolerances, make adjustments and retest.
- ☐ Confirm auxiliary (strip) heat cannot operate at outdoor temperatures above 35°F (or the lowest temperature setting allowed by the thermostat).

Submit the following to Idaho Power

To avoid a delay in processing, ensure forms and worksheets are completed in full.

- ☐ Open Loop Water Source Heat Pump Incentive Application
- ☐ Open Loop Water Source Heat Pump Installation Worksheet
- ☐ Certificate of AHRI-Certified Performance
- ☐ Manual J or equivalent (such as the Idaho Power Heat Pump Sizing Worksheet). Use care in selecting the proper Entering Water Temperature when selecting equipment.
- ☐ Copy of itemized receipt/invoice

C. Oil or Propane Heating System to Open Loop Water Source Heat Pump Criteria

Equipment Qualification

- ☐ Heat pump is
  - Minimum 3.5 COP as listed on AHRI certificate
- ☐ Heat pump is 6 tons or less
- ☐ Heat pump is sized using Manual J and Manual S or equivalent and selected coil combination has capacity that is within ½ ton of the calculated dominant (larger) load. The cooling design load is calculated at the appropriate design temperature and includes solar gains. The heating load shall be calculated at 30°F outside temperature (30°F balance point method).
- ☐ Home is located in an area where natural gas is not available.
- ☐ Limited to one unit per household.

Installation Qualification

- ☐ Visually inspect ductwork; verify there are no disconnected ducts. Repair disconnect(s) before installing equipment.
- ☐ Confirm system airflow is at least 350 CFM/Ton as measured with TrueFlow® Meter. Refer to Appendix E for general guidance on duct sizing.
- ☐ Compare measured loop and air-side temperature splits to manufacturer's targets. If measured values are not within manufacturer tolerances, make adjustments and retest.
- ☐ Confirm auxiliary (strip) heat cannot operate at outdoor temperatures above 35°F (or the lowest temperature setting allowed by the thermostat).

Continued on next page

Submit the following to Idaho Power

To avoid a delay in processing, ensure forms and worksheets are completed in full.

- ☐ Open Loop Water Source Heat Pump Incentive Application
- ☐ Open Loop Water Source Heat Pump Installation Worksheet
- ☐ Certificate of AHRI-Certified Performance
- ☐ Manual J or equivalent (such as the Idaho Power Heat Pump Sizing Worksheet). Use care in selecting the proper Entering Water Temperature when selecting equipment.
- ☐ Copy of itemized receipt/invoice

D. New Construction Open Loop Water Source Heat Pump Criteria

Equipment Qualification

- ☐ Heat pump is
  - Minimum 3.5 COP as listed on AHRI certificate
- ☐ Heat pump is 6 tons or less
- ☐ Heat pump is sized using Manual J and Manual S or equivalent and selected coil combination has capacity that is within ½ ton of the calculated dominant (larger) load. The cooling design load is calculated at the appropriate design temperature and includes solar gains. The heating load shall be calculated at 30°F outside temperature (30°F balance point method).
- ☐ Home is constructed in an area where natural gas is not available.
- ☐ Limited to one unit per household.
- ☐ Construction must be completed and certificate of occupancy issued prior to submitting incentive paperwork.

Installation Qualification

- ☐ Visually inspect ductwork; verify there are no disconnected ducts. Repair disconnect(s) before installing equipment.
- ☐ Confirm system airflow is at least 350 CFM/Ton as measured with TrueFlow® Meter. Refer to Appendix E for general guidance on duct sizing.
- ☐ Compare measured loop and air-side temperature splits to manufacturer's targets. If measured values are not within manufacturer tolerances, make adjustments and retest.
- ☐ Confirm auxiliary (strip) heat cannot operate at outdoor temperatures above 35°F (or the lowest temperature setting allowed by the thermostat).

Submit the following to Idaho Power

To avoid a delay in processing, ensure forms and worksheets are completed in full.

- ☐ Open Loop Water Source Heat Pump Incentive Application
- ☐ Open Loop Water Source Heat Pump Installation Worksheet
- ☐ Certificate of AHRI-Certified Performance
- ☐ Manual J or equivalent (such as the Idaho Power Heat Pump Sizing Worksheet). Use care in selecting the proper Entering Water Temperature when selecting equipment.
- ☐ Copy of itemized receipt/invoice

APPENDIX A

Equipment Sizing

All equipment must be sized using Manual J and Manual S or equivalent and the selected coil combination should have capacity that is within ½ ton of the calculated dominant (larger) load. The cooling design load should be calculated at the appropriate design temperature and include solar gains. The heating load should be calculated at 30°F outside temperature (30°F balance point method). The Idaho Power Heat Pump Sizing Worksheet will suffice.

For air-source systems, the Program recommends using the 30°F balance point chart in combination with the calculated heating load when sizing a heat pump to meet heating load. A Heat Pump Balance Point Chart is provided on the Heat Pump Sizing Worksheet and page 14 of this Manual. Select the heat pump size that corresponds to the design heating load of the house. (You can choose lower balance points, if desired.)

For water-source systems, the installer is strongly cautioned to use the proper entering water temperature when selecting equipment.

Heat Loss/Gain Worksheet Instructions

For each appropriate surface, use respective R-Value (insulation), door type, and orientation (windows) to calculate heating BTUs and cooling BTUs. **Inspection of the house before preparing the heat loss/gain calculations is strongly recommended**. Then, add the ACH multiplier, number of people/appliances and duct multiplier (using the information from the first page of the heat loss form where appropriate).

Design Temperature Offset Note: The numbers represented in the Idaho Power Heat Pump Equipment Sizing Worksheet are calculated based on an exterior winter temperature of 9°F (indoor thermostat setpoint of 70° F) and a summer temperature of 95°F (indoor thermostat setpoint of 75°F). These are the ASHRAE 97.5% design temperatures for Boise. If using other design condition temperatures, increase the design loads by the percentages shown in the Design Temperature Offset chart that correspond to the location where the equipment will be sited.

If you look closely, you will see that for each degree that the site is colder than Boise, heating load must be adjusted upward by 1.5% and for each degree warmer the cooling load must be adjusted upward by 1.5%.

For example, a system installed in Twin Falls has a Design Heating Temperature of 2° F rather than 9° F (Boise). The heating load must be adjusted upward by 7*1.5% or 10.5%. The cooling load does not need to be adjusted because the Design Cooling Temperature is the same for both Boise and Twin Falls.

If you want to use a warmer design temperature than 95° F (100° F, say), you would adjust the peak cooling load upward by 5*1.5%, or 7.5%.

Once the design heat loss rate is found, the appropriate heat pump size (for heating) can be found quickly using the following table. Note: if cooling is found to be the dominant load, an appropriate coil combination must be determined by comparing the calculated peak cooling load with the manufacturer's capacity tables. Use the suggested outside temperature and entering dry bulb temperature found on the front page of the equipment sizing worksheet.

Heat Pump Balance Point Selection Chart

(based on 30º F balance point)

Design Heat Loss Rate (Btu/hr)	HP Size (tons)
22500	2
25000	2
27500	2
30000	2
32500	2.5
35000	2.5
37500	3
40000	3
42500	3.5
45000	3.5
47500	3.5
50000	4
52500	4
55000	4
57500	5
60000	5

APPENDIX B

Detailed Information on Airflow and Refrigerant Charge Testing

All heat pump equipment must be installed according to Program requirements. The installed equipment must meet airflow and refrigerant charge requirements as noted below.

- An airflow test is required to determine the system's airflow. The minimum airflow allowed is 350 CFM/ton. The Program requires the use of the TrueFlow® Air Handler Flow Meter (aka flow plate) to determine airflow. The flow plate gives a highly accurate CFM/Ton reading in a relatively short period of time. If the TrueFlow plate cannot be used due to physical limitations, an alternate test can be used. (See Appendix C.)

- Test the refrigerant charge. First, make any recommended line set adjustments. Run equipment for at least 15 minutes before taking readings. For systems installed in summer (outdoor temperature over 65°F), measure subcooling and compare with manufacturers target. Subcooling must be within 3°F of the target. If it is not, adjust charge and retest.

- For systems installed in winter (outdoor temperature below 65°F) either subcooling can be checked in heating mode (for systems with a TXV on the outdoor unit) or the operating pressures can be checked. Manufacturers supply data on expected suction and discharge operating pressure as a function of outdoor (ambient) temperature, so it is possible to assess refrigerant charge (once airflow has been measured and found to be at least 350 CFM/ton) by comparing measured operating pressures to target pressures. The system must run at least 15 minutes before readings are taken.

- Manufacturers typically provide a tolerance of +/- 5 or 10 psig around the targets. If the system pressures are not within these tolerances, gauge calibration must be assured. If the gauges are fine, charge must be adjusted and the operating pressures re-checked.

- In heating mode, the temperature split should be at least half of the OAT temperature (e.g. if OAT = 40°F, ΔT should be at least 20°F). In cooling, ΔT should be in the range of 17-22°F. If the ΔT is not within the expected range, determine the cause, fix and retest.

Contractors can improve airflow by doing a combination of the following:

- Fixing damaged or incomplete duct systems
- Installing new return ducts leading from an area that is difficult to heat directly to the furnace cabinet
- Cleaning return and supply registers and grilles
- Adjusting the fan speed
- Opening the damper
- Cleaning the coils

TrueFlow® Meter Test Instructions

1. Turn on air handler (by using fan-only switch or by turning on heat/AC). It is best to call for the flow that will be used during most of the year (probably heating). Make sure you know which stage is operating so you will divide the measured flow by the right number of tons. Check size of outdoor unit to get capacity (tons). Record which stage (if multistage compressor) that you test and the tons tested. Note size of system filter and where you will install the TrueFlow. Normally you will install the TrueFlow in place of the filter, but you can also install it at a return filter grille if needed.

2. Place static pressure tap in supply plenum; drill hole if needed. The hooked end of the tap should face into the air stream. Note it is generally better to place tap at least 6" away from any take-off or turning vane. If this position was used to measure static pressure as part of the external static pressure measurement, the tap does not need to be moved. If the system tested is a manufactured home, access the supply system through the nearest supply register. Temporarily remove the magnet from the static pressure tap, reach down into the supply boot (look out for sharp edges) and toss the tap back toward the furnace. You can also put this tap in another place on the supply side (refrigerant line penetration into air handler cabinet, for example).

3. Connect other end of hose (that leads to the pressure tap) to the Input side of the pressure gauge (Channel A). Turn on gauge (if using DG-700 or similar). If using DG-700, switch to inches of water mode by using Units switch. Keep gauge in pressure/pressure mode for all tests.

4. Record normal supply operating pressure (NSOP) on form. If reading is very "jumpy", pressure Average key and wait at least 5 seconds for the average value to display.

5. Now remove system filter and replace with TrueFlow outfitted with any needed spacers. Note plate size on form. Plate should be positioned so side with labels faces oncoming air flow. Connect plate hoses to Channel B of pressure gauge (if using DG-700); otherwise, connect plate hoses so they will read pressure drop across plate. Read pressure across plate; record on worksheet.

6. Look at the pressure in supply system with TrueFlow installed (TFSOP). This will read from Channel A on the gauge.

7. Look at NSOP and TFSOP. If they differ by more than 3 Pa or 0.02" water, look up a Correction Factor. Use look up table on TrueFlow laminated card to figure any needed correction. Factor = $\sqrt{\frac{NSOP}{TFSOP}}$

8. Read pressure across plate.

9. Using plate pressure, look up Raw Flow on laminated card. Make sure you look up the flow for the correct plate (#14 or #20).

10. Multiply Raw Flow by Correction Factor; this is Corrected Flow.

11. Divide Corrected Flow by Tested Tons to get CFM/ton. If flow is more than 350 CFM/ton, the system meets program specs.

APPENDIX C

Alternate Air Flow Measurement Worksheets

Note: These methods to be used **only** if TrueFlow plate cannot fit in filter slot or there is another physical limitation on its use.

Measuring Air Handler Flow, Temperature Rise Method (Electric Heat, °F)

1. Call for emergency heat and let equipment run for at least 10 minutes.
2. Measure static pressure in supply plenum and record: _____ (specify if units are Pa or inches W.C.)
3. Measure return plenum temperature and record: _____ °F.
4. Measure supply temperature(s). If possible, measure in closest register to minimize radiant gain problem. Specify where measured:

   Record supply reading(s) in degrees F:

   Record average:_____ °F
5. Subtract return temp from average of supply temps (for example, 110° F – 70° F = 40° F):

   Show work: _____

6. Record element amps and volts to get input Watts.
   Note: It is critical to make sure elements is/are not sequencing on/off during this step.

Element	amps	volts	Watts
1			
2			
3			
4			
		Total	

7. CFM: (Total °F Watts from Step 6 * 3.16)/(temp.rise from Step 5) _____
   (example: (15,500 * 3.16)/40 =1225 CFM)

   Show work:

   Record CFM: _____ Divide CFM by outdoor unit size (tons) to get CFM/ton: _____.

8. Turn on system to get compressor operation; wait until system ramps up to full flow. Measure static pressure in supply plenum: _____. (specify units (Pa or inches water)). If static pressure measured here is different from static measured in Step 2, a correction is needed (see Step 9).

9. Correction factor (if needed): square root(Step 2 result_____/Step 8 result_____) *
   Step 7 result _____= revised CFM/ton_____.

Measuring Air Handler Flow With Temperature Rise (Gas Heat, °F)

Note: For best results, this procedure requires reading the gas meter and measuring combustion efficiency.

1. Turn up thermostat and let system run at least 10 minutes.

2. Measure static pressure in supply plenum and record: _____ (specify if units are Pa or inches W.C.)

3. Record combustion efficiency for each port in natural draft equipment or use single reading for induced draft equipment:_____/_____/_____/_____/_____

   Average efficiency: _____%

Note: If not measuring this directly, record assumed efficiency from dataplate_____

4. Measure return plenum temperature: _____ ° F

5. Measure supply temperature(s):

   Record reading(s) in degrees F:

   Record average: _____ ° F

6. Subtract return temp from average of supply temps (for example, 110° F – 70° F = 40° F):

   Show work: _____

7. Clock the meter by timing several revolutions of the ½ or 1 CCF dial (assume 1000 BTU/CCF if not otherwise known.) You must determine that no other gas appliances served by this meter are on during this step.

   CCFs:_____ BTU/CCF:_____ Time:_____ seconds

   Total input consumption = (CCF * BTU/CCF) /(seconds for revs) * 3600 sec/h
   =_____BTUh at meter

8. Multiply result from Step 6 by the combustion efficiency (Step 2):
   _____Btu/hr at meter * _____avg effic = _____ Btu/hr into supply airstream

9. Find system airflow in standard CFM:
   (Step 7 result_____)/(temp rise _____(Step 5 result) *1.08) = _____CFM
   Divide by capacity of outdoor unit to get CFM/ton: _____

10. Turn on system to get compressor operation; wait until system ramps up to full flow. Measure static pressure in supply plenum _____ specify units (Pa or inches water). If static pressure measured here is different from static measured in Step 1, a correction is needed (see Step 10).

11. Correction factor (if needed): square root(Step 2 result_____/Step 10 result_____) * Step 9 result _____= revised CFM/ton_____

APPENDIX D

Water Source Heat Pump Technical Information

Table 1: Water Temperature Change Through Heat Exchanger

WATER FLOW RATE (GPM)	COOLING RISE (F)		HEATING DROP (F)	
	Min	Max	Min	Max
For Closed Loop: Ground Source or Cooling/Boiler Systems at 3 gpm/ton	9	12	4	8
For Open Loop: Ground Water Systems at 1.5 gpm/ton	20	26	10	17

Table 2: Typical Unit Operating Pressures and Temperatures R22

ENTERING WATER TEMP (F) (EWT)	GPM/ TON	COOLING						HEATING					
		Suction Pressure (psig)	Discharge Pressure (psig)	Super-heat (F)	Sub-cooling (F)	Water Temp Rise (F)	Air Temp Drop (F) DB	Suction Pressure (psig)	Discharge Pressure (psig)	Super-heat (F)	Sub-cooling (F)	Water Temp Drop (F) DB	Air Temp Rise (F)
30	1.5	75-85	90-105	25-40	12-20	21-24	21-26	34- 39	167-186	12-16	1-4	7.6- 8.4	14-20
	2.3	74-84	80- 95	25-40	11-18	13-16	21-26	37- 43	172-191	12-16	1-4	4.8- 5.6	16-22
	3.0	73-83	70- 85	25-40	10-16	6-11	21-26	40- 46	177-196	12-16	1-4	3.4- 4.2	16-22
50	1.5	75-85	125-155	12-20	10-18	20-23	20-25	50- 60	180-210	10-17	1-5	10.8-11.9	23-29
	2.3	74-84	120-142	12-20	9-16	12-15	20-25	53- 62	185-215	10-17	1-5	6.7- 8.1	24-30
	3.0	73-83	115-138	12-20	8-14	8-12	20-25	55- 65	190-220	10-17	1-5	5.1- 5.9	25-31
70	1.5	75-85	179-198	9-16	8-15	19-22	19-24	71- 82	205-230	14-19	1-5	14.0-15.2	28-34
	2.3	74-84	168-186	9-16	8-14	12-17	19-24	73- 85	210-238	14-19	1-5	9.0-10.2	30-37
	3.0	73-83	158-175	9-16	8-12	7-12	19-24	76- 88	215-242	14-19	1-5	6.7- 7.9	31-38
90	1.5	75-85	229-251	9-17	8-15	18-21	17-23	85- 95	220-260	18-28	2-5	14.4-16.6	32-39
	2.3	74-84	218-241	9-17	8-14	10-14	17-23	90-100	225-265	18-28	2-5	10.8-12.4	33-41
	3.0	73-83	208-230	9-17	8-12	6-11	17-23	95-105	230-270	18-28	2-5	7.2- 8.3	35-42
110	1.5	77-87	280-320	8-15	10-25	17-20	15-20						
	2.3	76-86	270-310	8-15	10-24	9-13	15-20						
	3.0	75-85	260-300	8-15	10-22	5-10	15-20						

Legend:

DB — Dry Bulb

EAT — Entering Air Temperature

Notes:

1. Based on nominal 400 cfm per ton airflow, 70 F EAT heating and 80/67 F EAT cooling.

2. Cooling air and water numbers can vary greatly with changes in humidity.

3. Subcooling is based upon the head pressure at compressor service port.

Table 3: Typical Unit Operating Pressures and Temperatures R410A ***(Courtesy of Climatemaster Corp.)***

H/V/D - 018		Full Load Cooling - without HWG active						Full Load Heating - without HWG active					
Entering Water Temp F	Water Flow GPM/ton	Suction Pressure PSIG	Discharge Pressure PSIG	Super-heat	Sub-cooling	Water Temp Rise F	Air Temp Drop F DB	Suction Pressure PSIG	Discharge Pressure PSIG	Super-heat	Sub-cooling	Water Temp Drop F	Air Temp Rise F DB
30	1.5	120-130	155-175	27-32	11-16	16.9-19.9	16-22	73-83	268-288	8-13	4-9	6.1-8.1	15-21
	2.25	120-130	142-162	27-32	9-14	12.5-14.5	17-23	75-85	270-290	8-13	4-9	4.4-6.4	16-22
	3	120-130	128-148	27-32	9-14	8.1-10.1	17-23	78-88	272-292	8-13	4-9	2.9-4.9	16-22
50	1.5	137-147	220-240	16-21	10-15	17-19	16-22	102-112	295-315	8-13	8-13	9.1-11.1	20-26
	2.25	137-147	206-226	16-21	8-13	12.6-14.6	17-23	106-116	297-317	8-13	8-13	6.9-8.9	21-27
	3	137-147	192-212	16-21	8-13	8.4-10.4	17-23	110-120	299-319	8-13	8-13	4.7-6.7	21-27
70	1.5	142-152	287-307	7-12	10-15	15.9-17.9	16-22	131-141	324-344	9-14	10-15	12.1-14.1	25-33
	2.25	142-152	273-239	7-12	8-13	11.8-13.8	17-23	137-147	326-346	9-14	10-15	9.3-11.3	26-34
	3	142-152	259-279	7-12	8-13	7.8-9.8	17-23	144-154	328-348	9-14	10-15	6.6-8.6	26-34
90	1.5	146-156	375-395	6-11	10-15	14.9-16.9	16-22	174-184	360-380	10-15	12-17	15.8-17.8	32-40
	2.25	146-156	361-381	6-11	8-13	11-13	17-23	180-190	367-387	11-16	12-17	11.9-13.9	33-41
	3	146-156	347-367	6-11	8-13	7.2-9.2	17-23	187-197	374-394	12-17	12-17	8-10	33-41
110	1.5	154-164	478-498	6-11	10-15	14-16	16-22						
	2.25	154-164	461-481	6-11	8-13	10.2-12.2	16-22						
	3	154-164	445-465	6-11	8-13	6.5-8.5	16-22						

H/V/D - 024		Full Load Cooling - without HWG active						Full Load Heating - without HWG active					
Entering Water Temp F	Water Flow GPM/ton	Suction Pressure PSIG	Discharge Pressure PSIG	Super-heat	Sub-cooling	Water Temp Rise F	Air Temp Drop F DB	Suction Pressure PSIG	Discharge Pressure PSIG	Super-heat	Sub-cooling	Water Temp Drop F	Air Temp Rise F DB
30	1.5	115-125	154-174	40-45	8-13	16.5-18.5	19-25	73-83	283-303	8-12	6-11	5.9-7.9	16-22
	2.25	115-125	141-161	40-45	6-11	12.1-14.1	20-26	75-85	285-305	8-12	6-11	4.2-6.2	17-23
	3	115-125	127-147	40-45	6-11	77.7-9.7	20-26	78-88	287-307	8-12	6-11	2.7-4.7	18-24
50	1.5	115-120	209-229	24-29	10-15	15.7-17.7	18-24	102-112	313-333	8-12	8-13	8.9-10.9	22-28
	2.25	115-120	195-215	24-29	8-13	11.6-13.6	18-24	106-116	314-334	8-12	8-13	6.7-8.7	23-29
	3	115-120	181-201	24-29	8-13	7.6-9.6	18-24	110-120	316-336	8-12	8-13	4.5-6.5	23-29
70	1.5	136-146	275-295	6-11	6-11	15.7-17.7	18-24	128-138	340-360	9-14	9-14	11.3-13.3	27-34
	2.25	136-146	261-281	6-11	5-10	11.6-13.6	18-24	134-144	342-362	9-14	9-14	8.5-10.5	28-35
	3	136-146	247-267	6-11	4-9	7.6-9.6	18-24	141-151	344-364	9-14	9-14	5.8-7.8	28-35
90	1.5	140-150	361-381	6-11	6-11	14.9-16.9	18-24	162-172	370-390	14-19	9-14	14.4-16.4	32-40
	2.25	140-150	347-367	6-11	5-10	11-13	18-24	166-176	376-396	15-20	9-14	10.8-12.8	34-42
	3	140-150	333-353	6-11	4-9	7.2-9.2	18-24	171-181	383-403	16-21	9-14	7.1-9.1	34-42
110	1.5	144-154	460-480	6-11	6-11	13.9-15.9	17-23						
	2.25	144-154	445-465	6-11	4-9	10.2-12.2	17-23						
	3	144-154	428-448	6-11	4-9	6.5-8.5	17-23						

H/V/D - 030		Full Load Cooling - without HWG active						Full Load Heating - without HWG active					
Entering Water Temp F	Water Flow GPM/ton	Suction Pressure PSIG	Discharge Pressure PSIG	Super-heat	Sub-cooling	Water Temp Rise F	Air Temp Drop F DB	Suction Pressure PSIG	Discharge Pressure PSIG	Super-heat	Sub-cooling	Water Temp Drop F	Air Temp Rise F DB
30	1.5	116-126	146-166	27-32	7-13	19.6-21.6	16-22	69-79	275-295	7-12	6-11	7.2-9.2	16-22
	2.25	115-125	138-158	27-32	6-11	14.3-16.3	17-23	73-83	277-297	7-12	6-11	5.4-7.4	17-23
	3	115-125	128-148	27-32	6-11	8-10	17-23	76-86	279-299	7-12	6-11	3.5-5.5	17-23
50	1.5	129-139	217-237	12-17	6-11	20.8-22.8	17-23	96-106	300-320	10-15	9-14	10.5-12.5	21-27
	2.25	128-138	203-223	12-17	5-10	15-17	18-24	100-110	304-324	10-15	9-14	7.6-9.6	22-28
	3	128-138	189-209	12-17	5-10	9.2-11.2	18-24	105-115	309-329	10-15	9-14	4.8-6.8	22-28
70	1.5	132-142	293-313	9-14	6-11	20.1-22.1	17-23	123-133	327-347	11-16	11-16	13.2-15.2	25-32
	2.25	131-141	274-294	9-14	5-10	14.4-16.4	18-24	129-139	333-353	11-16	11-16	9.8-11.8	26-33
	3	131-141	256-276	9-14	5-10	8.6-10.6	18-24	135-145	339-359	11-16	11-16	6.4-8.4	27-34
90	1.5	137-147	383-403	7-12	5-10	19.4-21.4	16-22	155-165	355-375	13-18	11-16	16.8-18.8	30-38
	2.25	137-147	362-382	7-12	5-10	13.8-15.8	16-22	162-172	362-382	14-19	11-16	12.7-14.7	31-39
	3	137-147	342-362	7-12	5-10	8.2-10.2	16-22	169-179	369-389	16-21	11-16	8.6-10.6	32-40
110	1.5	143-153	475-495	6-11	9-14	18.2-20.2	16-22						
	2.25	143-153	457-477	6-11	6-11	13-14	16-22						
	3	143-153	439-459	6-11	6-11	7.7-9.7	16-22						

H/V/D - 036		Full Load Cooling - without HWG active						Full Load Heating - without HWG active					
Entering Water Temp F	Water Flow GPM/ton	Suction Pressure PSIG	Discharge Pressure PSIG	Super-heat	Sub-cooling	Water Temp Rise F	Air Temp Drop F DB	Suction Pressure PSIG	Discharge Pressure PSIG	Super-heat	Sub-cooling	Water Temp Drop F	Air Temp Rise F DB
30	1.5	117-127	142-162	33-38	8-14	19.1-21.1	15-22	69-79	276-296	10-15	10-15	7.2-9.2	17-23
	2.25	116-126	134-154	33-38	7-12	13.8-15.8	15-22	73-83	278-298	10-15	10-15	5.3-7.3	18-24
	3	116-126	124-144	33-38	7-12	7.4-9.4	15-22	76-86	280-300	10-15	10-15	3.5-5.5	18-24
50	1.5	136-146	211-231	11-16	6-11	20.6-22.6	17-23	99-109	302-322	10-15	13-18	10.6-12.6	22-28
	2.25	136-146	197-217	11-16	5-10	14.8-16.8	17-23	103-113	306-326	10-15	13-18	7.7-9.7	23-29
	3	136-146	183-203	11-16	5-10	9-11	17-23	108-118	311-331	10-15	13-18	5-7	23-29
70	1.5	137-147	275-295	9-14	10-15	19-21	18-24	127-137	332-352	10-15	15-20	13.5-15.5	27-34
	2.25	137-147	260-280	9-14	9-14	13.8-15.8	19-25	133-143	338-358	10-15	15-20	10.1-12.1	28-35
	3	137-147	245-265	9-14	9-14	8-10	19-25	139-149	344-364	10-15	15-20	6.7-8.7	29-36
90	1.5	142-152	373-393	7-12	10-15	19.5-21.5	17-23	164-174	365-385	11-16	15-20	17.4-19.4	34-42
	2.25	142-152	352-372	8-13	6-11	13.9-15.9	17-23	172-182	372-392	11-16	15-20	13.2-15.2	35-43
	3	142-152	332-352	8-13	6-11	8.3-10.3	17-23	181-191	379-399	12-17	15-20	9-11	36-44
110	1.5	147-157	467-487	6-11	10-15	16.2-18.2	16-22						
	2.25	147-157	448-468	6-11	8-13	11.9-13.9	16-22						
	3	147-157	430-450	6-11	7-12	7.6-9.6	16-22						

Table 3: TS Series Typical Unit Operating Pressures and Temperatures R410A (continued)

H/V/F - 042		Full Load Cooling - without HWG active						Full Load Heating - without HWG active					
Entering Water Temp F	Water Flow GPM/ton	Suction Pressure PSIG	Discharge Pressure PSIG	Super-heat	Sub-cooling	Water Temp Drop F	Air Temp Rise F DB	Suction Pressure PSIG	Discharge Pressure PSIG	Super-heat	Sub-cooling	Water Temp Drop F	Air Temp Rise F DB
30	1.5	114-124	170-190	27-32	10-15	17.2-19.2	17-23	69-79	286-306	5-10	5-10	4.5-6.5	16-22
	2.25	113-123	150-170	27-32	9-14	12.7-14.7	17-23	72-82	289-309	5-10	6-11	3.9-5.9	17-23
	3	113-123	131-151	27-32	7-12	8.2-10.2	17-23	75-85	292-312	6-11	6-11	3.2-5.2	18-24
50	1.5	130-140	226-246	10-15	6-11	17.8-19.8	20-26	100-110	315-335	7-12	6-11	9-11	22-28
	2.25	129-139	208-228	10-15	5-10	13.3-15.3	20-26	105-115	322-342	8-13	6-11	7-9	23-29
	3	129-139	190-210	10-15	4-9	8.8-10.8	20-26	110-120	330-350	10-15	7-12	5-7	24-30
70	1.5	132-142	290-310	6-11	6-11	17.3-19.3	19-25	131-141	347-367	11-16	6-11	13.4-15.4	29-35
	2.25	131-141	273-293	6-11	5-10	12.8-14.8	19-25	138-148	358-378	13-18	8-13	10-12	30-36
	3	131-141	255-275	6-11	4-9	8.3-10.3	19-25	145-155	369-389	16-21	9-14	6.9-8.9	31-37
90	1.5	136-146	370-390	6-11	6-11	16-18	17-23	175-185	393-413	19-24	7-12	17.6-19.6	36-42
	2.25	135-145	350-370	6-11	5-10	11.8-13.8	17-23	177-187	401-421	20-25	9-14	13.2-15.2	37-43
	3	135-145	330-350	6-11	4-9	7.6-9.6	17-23	180-190	409-429	22-27	12-17	8.7-10.7	38-44
110	1.5	143-153	469-489	6-11	6-11	14-16	16-22						
	2.25	142-152	448-468	6-11	5-10	11-13	16-22						
	3	141-151	427-447	6-11	4-9	7-9	16-22						

H/V/D - 048		Full Load Cooling - without HWG active						Full Load Heating - without HWG active					
Entering Water Temp F	Water Flow GPM/ton	Suction Pressure PSIG	Discharge Pressure PSIG	Super-heat	Sub-cooling	Water Temp Drop F	Air Temp Rise F DB	Suction Pressure PSIG	Discharge Pressure PSIG	Super-heat	Sub-cooling	Water Temp Drop F	Air Temp Rise F DB
30	1.5	108-118	180-200	27-32	12-17	19.8-21.8	19-25	65-75	293-313	7-12	9-14	8.2-10.2	17-23
	2.25	107-117	161-181	28-33	10-15	14.8-16.8	19-25	68-78	297-217	8-13	9-14	6.2-8.2	18-24
	3	107-117	142-162	29-34	9-14	9.8-11.8	19-25	72-82	301-321	9-14	9-14	4.2-6.2	19-25
50	1.5	123-133	236-256	16-21	8-13	20.2-22.2	21-27	92-102	321-341	10-15	11-16	11.6-13.6	23-29
	2.25	122-132	218-238	17-22	7-12	15.2-18.2	21-27	100-110	330-350	11-16	11-16	8.9-10.9	24-30
	3	122-132	200-220	17-22	6-11	10.2-12.2	21-27	108-118	340-360	12-17	11-16	6-8	26-32
70	1.5	130-140	305-325	10-15	8-13	20-22	20-26	122-132	353-373	12-17	11-16	15-17	29-35
	2.25	129-139	285-305	11-16	6-11	15-17	20-26	133-143	365-385	14-19	11-16	11.5-13.5	31-37
	3	129-139	265-285	11-16	5-10	10-12	20-26	144-154	378-398	16-21	11-16	8-10	33-39
90	1.5	133-143	390-410	8-13	8-13	19-21	19-25	166-176	397-417	16-21	9-14	19.5-21.5	37-43
	2.25	132-142	368-388	9-14	6-11	14-16	19-25	173-183	407-727	18-23	9-14	14.7-16.7	38-44
	3	132-142	345-365	9-14	5-10	9-11	19-25	181-191	417-437	19-24	10-15	9.9-11.9	40-46
110	1.5	141-151	497-517	6-11	8-13	18-20	18-24						
	2.25	140-150	472-492	7-12	6-11	13.5-15.5	18-24						
	3	140-150	447-467	8-13	5-10	8.7-10.7	18-24						

H/V/D - 060		Full Load Cooling - without HWG active						Full Load Heating - without HWG active					
Entering Water Temp F	Water Flow GPM/ton	Suction Pressure PSIG	Discharge Pressure PSIG	Super-heat	Sub-cooling	Water Temp Drop F	Air Temp Rise F DB	Suction Pressure PSIG	Discharge Pressure PSIG	Super-heat	Sub-cooling	Water Temp Drop F	Air Temp Rise F DB
30	1.5	98-108	160-180	40-45	12-17	20-22	19-25	62-72	276-296	6-11	6-11	8-10	17-23
	2.25	97-107	149-169	41-46	12-17	14.3-16.3	19-25	66-76	280-300	6-11	6-11	6-8	18-24
	3	96-106	137-157	42-48	11-16	8.5-10.5	20-26	70-80	284-304	7-12	6-11	4-6	19-25
50	1.5	118-128	225-245	36-41	11-16	21.2-23.2	19-25	88-98	306-326	10-15	8-13	11-13	23-29
	2.25	117-127	210-230	37-42	10-15	15.7-17.7	20-26	94-104	311-331	10-15	8-13	8.3-10.3	24-30
	3	115-125	195-215	38-43	9-14	10.2-12.2	21-27	100-110	317-337	11-16	9-14	5.5-7.5	25-31
70	1.5	135-145	300-320	12-17	9-14	20.3-22.3	21-27	112-122	333-353	12-17	10-15	14-16	28-34
	2.25	133-143	285-305	14-19	8-13	15-17	21-27	122-132	342-362	14-19	10-15	10.5-12.5	30-36
	3	132-142	270-290	16-21	7-12	10-12	22-28	130-140	351-371	15-20	11-16	7.3-9.3	32-38
90	1.5	139-149	390-410	8-13	7-12	19.3-21.3	20-26	147-157	369-389	15-20	10-15	17.7-19.7	36-42
	2.25	138-148	370-390	8-13	6-11	14.3-16.3	21-27	154-164	377-397	18-23	10-15	13.4-15.4	37-43
	3	138-148	350-370	8-13	6-11	9.3-11.3	21-27	160-170	385-405	19-24	11-16	9-11	38-44
110	1.5	144-154	488-508	8-13	8-13	18.4-20.4	21-27						
	2.25	143-153	468-488	7-12	6-11	13.6-15.6	21-27						
	3	142-152	448-468	7-12	5-10	8.8-10.8	21-27						

H/V/D - 070		Full Load Cooling - without HWG active						Full Load Heating - without HWG active					
Entering Water Temp F	Water Flow GPM/ton	Suction Pressure PSIG	Discharge Pressure PSIG	Super-heat	Sub-cooling	Water Temp Drop F	Air Temp Rise F DB	Suction Pressure PSIG	Discharge Pressure PSIG	Super-heat	Sub-cooling	Water Temp Drop F	Air Temp Rise F DB
30	1.5	110-120	177-197	36-41	15-20	20.2-22.2	21-27	61-71	290-310	12-18	9-14	8-10	19-25
	2.25	109-119	162-182	37-42	13-18	15-17	21-27	65-75	292-312	12-18	10-15	6-8	20-26
	3	107-117	147-167	38-43	11-16	9.7-11.7	22-28	68-78	296-316	12-18	10-15	4-6	21-27
50	1.5	128-138	246-266	18-23	11-16	21-23	22-28	88-98	320-340	11-17	13-18	11.7-13.7	26-32
	2.25	128-138	228-248	19-24	9-14	15.6-17.6	23-29	96-106	330-350	11-17	11-16	9-11	27-33
	3	127-137	210-230	20-25	6-11	10.2-12.2	24-30	105-115	338-358	11-17	9-14	6-8	29-35
70	1.5	134-144	305-325	9-14	11-16	20.8-22.8	23-29	118-128	355-375	10-16	14-19	15.2-17.2	33-39
	2.25	133-143	289-309	9-14	9-14	15.4-17.4	23-29	130-140	368-388	12-18	13-18	11.7-13.7	35-41
	3	131-141	273-293	9-14	6-11	10-12	23-29	141-151	380-400	15-21	11-16	8-10	37-43
90	1.5	140-150	390-410	10-15	11-16	19.6-21.6	22-28	158-168	401-421	9-15	13-18	19.5-21.5	41-47
	2.25	139-149	373-393	10-15	9-14	14.5-16.5	22-28	168-178	412-432	10-16	12-17	14.8-16.8	43-49
	3	138-148	355-375	10-15	6-11	9.3-11.3	22-28	178-188	423-443	12-18	12-17	10-12	45-51
110	1.5	144-154	488-508	10-15	9-14	18.4-20.4	20-27						
	2.25	143-153	468-488	10-15	6-11	13.6-15.6	20-27						
	3	142-152	448-468	9-14	5-10	8.8-10.8	20-27						

Rev. 01/17/05JH

APPENDIX E

Quick Duct Sizing Guide

ACCA's general rule is one net square foot of return grille per ton:

A 20 X 20 inch grill = 400 sq in
400 X .75 = 300 sq in net free area (NFA)
300 sq in / 144 sq in = 2.08 sq ft (just enough for a 2 ton system)

An ideal situation to maximize the performance of the heat pump unit is to have 6 sq. inches of duct on the supply side and return side for every 1,000 Btuh.

Example: A 2 ton AC (24,000 Btuh) would need 144 sq. inches of return and supply duct.

The Rules Applied

Gas Furnaces

Input BTUh	Sq. In. Ducts Needed (supply and return)
40,000	80
60,000	120
80,000	160
100,000	200
120,000	240

Heat Pump

Input BTUh	Sq. In. Ducts Needed (supply and return)
24,000	144
30,000	180
36,000	216
42,000	252
48,000	288

Round Duct Sq. In. Equivalency

Size	Sq. In.
5	20
6	28
7	38
8	50
9	64
10	79

Size	Sq. In.
12	113
14	154
16	201
18	254
20	314
22	380

Source: Delta-T, Inc.